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## (54) FERROMAGNETIC TUNNEL ELEMENT AND ITS PRODUCTION

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To produce a magnetic sensor having excellent characteristics showing large change in the resistance in a weak magnetic field with good production yield by forming a tunnel joint of a three-layer structure of ferromagnetic layer/ insulating layer/ferromagnetic layer and forming an antiferromagnetic layer on the outside of the one ferromagnetic layer of the tunnel joint.

**SOLUTION:** A Si substrate is laminated with a Fe film 2 as a ferromagnetic film, an alumina film 3 as a tunnel insulating film, a Fe film 4 as a ferromagnetic film, and a FeMn film or NiMn 5 as an antiferromagnetic film. Since FeMn grows as  $\gamma$ -FeMn on NiFe, it shows antiferromagnetism in an As-deposited state. On the other hand, NiMn is not antiferromagnetic in an As-deposited state but forms a regular grating by heat treatment and changes into an antiferromagnetic material. Therefore, the element having NiMn is heat treated in vacuum.



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